

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

December 27, 2000

MEMORANDUM

SUBJECT: Applicability of RCRA Section 3020 to In-Situ Treatment of Ground Water

FROM: Elizabeth Cotsworth, Director /S/
Office of Solid Waste

TO: RCRA Senior Policy Advisors
RCRA Enforcement Managers
Superfund Regional Policy Managers

We have recently received several questions on how the Resource Conservation and Recovery Act (RCRA) applies to the reinjection of ground water contaminated with hazardous waste during cleanups, and particularly on the applicability of section 3020(b) of RCRA to ground-water remedies involving in-situ bioremediation and other forms of in-situ treatment. This memorandum clarifies that reinjection of treated ground water to promote in-situ treatment is allowed under section 3020(b) as long as certain conditions are met. Specifically, the ground water must be treated prior to reinjection; the treatment must be intended to substantially reduce hazardous constituents in the ground water - either before or after reinjection; the cleanup must be protective of human health and the environment; and the injection must be part of a response action under CERCLA section 104 or 106 or a RCRA corrective action intended to clean up the contamination.

Background

Section 3020 of RCRA addresses the underground injection of hazardous waste in the context of RCRA and CERCLA cleanups. RCRA section 3020(a) bans hazardous waste disposal by underground injection into a formation which contains an underground source of drinking water (within one-quarter mile of the well), or above such a formation. However, RCRA section 3020(b) exempts from the ban reinjection of treated contaminated ground water withdrawn from an aquifer, if the following criteria are met: (1) the reinjection is a CERCLA section 104 or 106 response action or part of a RCRA corrective action intended to clean up the contamination, (2)

the contaminated ground water is treated to substantially reduce hazardous constituents prior to such reinjection, and (3) the response action or corrective action is sufficient to protect human health and the environment upon completion.¹

In the past, EPA and state regulators have expressed concern that the RCRA land disposal restrictions (LDRs) might add further limitations on ground-water reinjection conducted as part of a RCRA or CERCLA action. The LDR requirements, found in RCRA sections 3004(f), (g), and (m) and codified at 40 CFR Part 268, establish specific treatment standards that *restricted* hazardous waste must meet before it may be disposed of in a *land disposal* unit. Ground water being reinjected may contain a restricted waste, and injection of hazardous waste into underground injection wells is land disposal under LDR. To address concerns that these treatment requirements might limit the scope of the section 3020(b) exemption, EPA issued a clarifying memorandum on December 27, 1989. The memorandum stated that contaminated ground water reinjected during the course of RCRA or CERCLA cleanups in a manner consistent with the RCRA section 3020(b) exemption is not subject to RCRA land disposal restrictions. As the memorandum summarized, "EPA construes the provisions of RCRA section 3020 to be applicable instead of the LDR provisions at RCRA sections 3004(f), (g), and (m), to reinjections of contaminated ground water into an underground source of drinking water (USDW), which are part of a CERCLA response action or RCRA corrective action." (emphasis added) (See Don R. Clay, Assistant Administrator for Solid Waste and Emergency Response, to EPA Waste Management Division Directors and Regional Counsels, OSWER Directive #9234.1-06; a copy of the memorandum is attached.)²

EPA's December 27, 1989 memorandum, therefore, clarified the relationship between RCRA section 3020 and the LDR requirements. Since that memorandum, EPA has received additional inquiries on the scope of section 3020, particularly as it applies to ground-water remedies involving in-situ bioremediation and other in-situ treatment. The remainder of this memorandum addresses those inquiries.

¹Prior to the 1984 amendments to RCRA that included section 3020, EPA promulgated very similar requirements in the implementing regulations for the Underground Injection Control (UIC) Program at 40 CFR 144.13. Additional clarification for injection wells at section 144.13(d) provides exemptions from the prohibition on Class IV wells (wells involving the injection of hazardous waste) in cases where the aquifer has been exempted pursuant to specific criteria, or where no underground source of drinking water (USDW) source exists within one quarter mile of the injection well.

²Questions have been raised as to whether the Corrective Action Management Unit (CAMU) rule superseded this 1989 directive. EPA emphasizes that the CAMU requirements do not supercede the 1989 memo. In addition, questions have been raised as to whether Minimum Technological Requirements (MTRs) apply to reinjection. MTRs apply to landfills, surface impoundments, and waste piles and therefore are not relevant to reinjection.

Application of Section 3020(b) to In-situ Treatment

As the December 27, 1989 memorandum stated, the RCRA section 3020(b) exemption from the ban on hazardous waste injection applies to reinjected ground water only if the ground water "is treated to substantially reduce hazardous constituents prior to such injection", and the injection meets the other requirements for exemption. The memorandum further stated that "steps necessary to 'substantially reduce' hazardous constituents should be decided on a case-by-case basis," until further guidance is developed. Today's memorandum clarifies one element of the requirement for substantial treatment.³

EPA interprets section 3020(b)(2) to require that contaminated ground water withdrawn from an aquifer be treated prior to reinjection and that the treatment be intended to "substantially reduce" hazardous constituents in the ground water. But the "substantial reduction" may occur either before or after reinjection. To be more specific, the reduction may occur "in-situ" after reinjection of the ground water into the aquifer (that is, within the formation that is the target zone for the injected fluid). The intended treatment must reasonably be expected to reduce levels of contamination and must be part of a legitimate effort to achieve cleanup of such contamination. As long as the reinjection meets these conditions (and the other conditions of section 3020(b)), it may occur without triggering the section 3020(a) prohibition on underground injection of hazardous wastes or the RCRA land disposal restrictions.

This clarification is particularly relevant to in-situ ground-water bioremediation. Over the last decade, government, academic, and industrial researchers have investigated and piloted remedial systems that rely on "enhanced" or "engineered" in-situ bioremediation of contaminated ground water to promote treatment or increase biodegradation of hazardous constituents. These remedial systems can be used to clean up ground water contaminated with petroleum hydrocarbons, chlorinated aromatics, chlorinated solvents, and other common pollutants. In these systems, remediators stimulate the biodegradation of pollutants by manipulating subsurface conditions (for example, by adding nutrients) and in some cases by adding naturally-occurring or nonindigenous microorganisms. In many cases, contaminated ground water is extracted during the course of the remedy, amended to promote in-situ bioremediation, and reinjected. These "amendments" or "treatment agents" might include addition of microorganisms ("bioaugmentation"), nutrients (for example, phosphate or ammonium nitrate), electron donors (for example, oxygen, hydrogen peroxide, or specifically-designed commercial products), or substrates to promote microbial growth (for example, lactic acid, various alcohols, propane, or other chemical products). Amending the extracted contaminated ground water in any of these ways clearly constitutes "treatment" under RCRA (see section 1004(34)). Therefore, EPA considers these systems to be consistent with RCRA section 3020(b)(2) treatment requirement, as long as extracted ground water contaminated with hazardous waste is amended (or otherwise

³This memorandum also does not address what degree of treatment would be considered "substantial", which is a determination made on a case-by-case basis.

"treated") before reinjection, and as long as the treatment is intended to achieve a substantial reduction of hazardous constituents after reinjection.⁴

EPA emphasizes that the general principle described above - that under section 3020(b)(2) "treatment" must occur prior to reinjection, but the "substantial reduction" of hazardous constituents in the ground water may occur after reinjection - applies to other in-situ treatment systems besides biotreatment, as long as they too comply with the conditions of section 3020(b). For example, it would potentially apply where ground water contaminated with hazardous waste is reinjected in the course of in-situ flushing or in-situ chemical oxidation. In-situ flushing is a ground-water cleanup method that involves the injection or infiltration of a flushing solution into a zone of contaminated soil and ground water, followed by downgradient extraction of ground water and elutriate (flushing solution mixed with contaminants). Flushing solutions typically include plain water, augmented by surfactants, co-solvents, or other treatment agents. The extracted ground water/elutriate mixture is treated above-ground to remove most of the contaminant, and then reinjected to repeat the flushing procedure.

In-situ chemical oxidation is another subsurface treatment method, involving the introduction of oxidizing agents into contaminated aquifers. Typical oxidants include hydrogen peroxide, potassium permanganate, and ozone. Delivery methods vary, but the oxidants are sometimes mixed with extracted ground water, which is then reinjected and recirculated. This method potentially can destroy or degrade an extensive variety of hazardous wastes, including volatile organic compounds (such as trichloroethylene and benzene) and semivolatile organic contaminants (such as certain pesticides, polycyclic aromatic hydrocarbons, and polychlorinated biphenyls) in ground water, sediment, and soil. These advanced technologies show great promise in addressing ground-water contamination.

In both of the systems described above, the addition of treatment agents to extracted contaminated ground water prior to reinjection constitutes "treatment," and therefore the reinjection would be allowable under section 3020(b), as long as the other conditions of that section were met.

EPA has occasionally been asked how RCRA applies to a commercial chemical or chemical product that is injected into ground water for in-situ treatment where no ground water is withdrawn and reinjected. RCRA subtitle C, including section 3020 (a), does not regulate material that is not a hazardous waste and thus does not prohibit the injection of a material into ground water during in-situ treatment if the material is not a hazardous waste. Therefore, as long as the injected materials are not hazardous wastes, the exemption in 3020(b) is not needed to allow the injection into ground water of flushing solution, oxidants, or other treatment agents without mixing with extracted ground water. If any of these substances qualify as a "hazardous

⁴Similarly, EPA considers these systems consistent with the UIC regulations at 40 CFR section 144.13.

waste," then its injection is subject to RCRA subtitle C regulation, and, if that injection is into or above a formation that contains an underground source of drinking water, it is prohibited by RCRA section 3020(a).

Under RCRA, a material is regulated under RCRA subtitle C only if it is a "hazardous waste" as defined in 40 CFR. section 261.3, and a material is only a "hazardous waste" if it meets the definition of "solid waste" in 40 CFR. section 261.2. A "solid waste" is defined in section 261.2 as a "discarded material." Commercial chemicals or chemical products generally are not "discarded," even when their use results in deposit on the land, if they are being used for their ordinary or original intended purpose. See section 261.2(c) (ii) (commercial chemical products are not solid wastes when applied to the land and that is "their ordinary manner of use") and section 261.33 introduction (enumerated commercial chemical products are solid wastes when "applied to the land in lieu of their original intended use"). For example, a pesticide applied on the land for the purpose of killing pests is not considered "discarded," and thus is not solid or hazardous waste subject to RCRA regulatory requirements. Similarly a commercial chemical or chemical product that is specially formulated to treat contamination and then is injected into ground water to treat that type of contamination is not considered discarded and is not subject to RCRA regulatory requirements.

A commercial chemical or chemical product injected into ground water also would not be subject to RCRA subtitle C regulations when it is injected into ground water to treat a type of contamination if it had been proved successful elsewhere in treating such contamination, or if it had been commonly used in other forms of treatment of such contamination, or if it had chemical properties that could legitimately be expected to promote in-situ treatment of that contamination. See *Self v. United States*, 2 F. 3d 1071, 1079-81 (10th Cir. 1993) (broadly construing ordinary manner of use/original intended purpose test to include uses furthering a generic rather than highly specific activity).

Eligible Cleanup Authorities

RCRA sections 3020(b)(1)(A) and 3020(b)(1)(B) limit the section 3020(b) exemption to "response actions" taken under CERCLA section 104 or 106 and to "corrective action" required under RCRA. EPA has frequently been asked to clarify its views on the scope of this limitation. First, the exemption of course applies to any CERCLA action under section 104 or 106, including actions where federal agencies other than EPA are the lead agency. Second, the exemption would apply to any actions taken at RCRA treatment, storage, or disposal facilities (TSDs) under RCRA "corrective action" authorities, including (but not limited to) sections 3004(u), 3004(v), and 3008(h). It would also apply to injections that occur as part of a remedy

under an authorized state corrective action program, as long as these injections met the other exemption requirements of RCRA section 3020(b).⁵

Other Considerations When Selecting Groundwater ReInjection as a Cleanup Remedy

EPA supports the types of activities described in this memorandum because they can often provide effective treatment in otherwise intractable situations. In approving ground-water remedies, regulators should consider the current and potential beneficial uses of the ground water, and the time it will take different remedies to achieve remedial goals, including whether the "substantial treatment" consistent with section 3020(b)(2) will occur within a reasonable period of time. The treatment timeframe should be consistent with the remedial goals for the site. Regulators should also be careful when selecting ground-water reInjection remedies to ensure that activities intended to remediate contamination, such as flushing, do not inadvertently result in any unacceptable migration of contaminants or treatment agents beyond the zone of treatment. To assure the action is sufficiently protective of human health and the environment, regulators should review methods for monitoring the proposed ground-water reInjection, and may want to consider hydraulic containment measures.

Conclusion

I trust these clarifications will facilitate the use of enhanced in-situ bioremediation and other ground-water remedies at sites where ground water is contaminated with RCRA hazardous waste. If you have any specific questions about these issues, contact Robert Hall, Deputy Director, Permits and State Programs Division, at 703-308-8432.

cc: Bruce Kobelski, OW
Larry Reed, OERR
Walter Kovalick, TIO
Barry Breen, OSRE
Betsy Devlin, ORE/RED
Tom Kennedy, ASTSWMO

Attachment

⁵Simply qualifying for the eligible cleanup authorities under section 3020(b) does not affect other regulatory obligations, whether federal, state, or local. For example, it does not obviate the need for operators of these injection systems to provide inventory information, or meet other specific requirements imposed by the UIC Program Director in direct implementation or primacy programs. Therefore, operators should coordinate with their state regulators to obtain, as necessary, variances, waivers, construction permits, approvals, etc., prior to reInjection under 3020(b) of the federal RCRA statute.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Office of Solid Waste and Emergency Response.
Dec 27 1989 OSWER Directive # 9234.1-06

MEMORANDUM

SUBJECT: Applicability of Land Disposal Restrictions to
RCRA and CERCLA Ground Water Treatment Reinjection
Superfund Management Review: Recommendation No. 2

FROM: Don R. Clay, Assistant Administrator
Office of Solid Waste and Emergency Response

TO: Waste Management Division Directors
Regions I - X

Regional Counsel
Regions 1 - X

There has been some question as to whether ground water contaminated with restricted RCRA hazardous wastes, which is extracted during a RCRA corrective action or CERCLA response action, must meet the best demonstrated available technology (BOAT) identified for that waste under the RCRA land disposal restrictions (LDRs) prior to each reinjection, in a pump-and-treat reinjection remediation system. (See RCRA sections 3004 (f), (g) and (m), and 40 C.F.R. Parts 148 and 268.) This memorandum explains EPA's interpretation of whether the LDRs are applicable or (under CERCLA response actions only) relevant and appropriate to such reinjections or to the remediation as a whole.

RCRA LDRs prohibit land disposal of restricted RCRA hazardous wastes that do not meet treatment standards after the effective date of the restrictions. Treatment standards for RCRA hazardous wastes are based upon the best demonstrated available technology (BDAT) identified for that waste, see 40 C.F.R. 268. Because placement of hazardous waste into underground injection wells constitutes "land disposal" under LDR (see RCRA section 3004 (k)), and the ground water undergoing reinjection may contain a restricted waste, the issue has been raised as to whether each reinjection of contaminated ground water should meet BDAT during response or corrective actions.

RATIONALE

Ground water restoration under RCRA corrective actions and CERCLA response actions often involves withdrawal, treatment of the contaminated water, and reinjection of the treated water into the ground. The land disposal restrictions (LDR) of the Resource Conservation and Recovery Act (RCRA) prohibit land disposal of restricted RCBA hazardous wastes that do not meet treatment standards after the effective date of the restrictions. Treatment standards for RCRA hazardous wastes are based upon the best demonstrated available technology (BDAT) identified for that waste, See 40. C.F.R. 268. Because placement of hazardous waste into underground injection wells constitutes "land disposal" under LDR (See RCBA section 300-4(JO)), and the ground water undergoing reinjection may contain a restricted waste, the issue has been raised as to whether "each reinjection of contaminated ground water should meet BDAT during response or corrective actions."¹

Section 3020 of RCRA [previously section 7010²] specifically addresses waste injection in the context of CERCLA and RCRA cleanups. RCRA section 3020(a) bans hazardous waste disposal by underground injection into or above an underground source of drinking water (within one-quarter mile of the well). However, RCRA section 3020 (b) exempts from the ban all reinjections of treated contaminated ground water into such formations undertaken as part of a CERCLA section 104 or 106 response action, or a RCRA corrective action. To qualify for the exemption, the following three conditions must be met: (1) the injection is a CERCLA response action or a RCRA corrective action, (2) the contaminated ground water must be treated to substantially reduce hazardous constituents prior to such injection, and (3) the response action or corrective action must be sufficient to protect human health and the environment upon completion.

Although RCRA section 3020 and the LDR provisions at RCRA sections 3004(f),(g) and (m) arguably can address the same activity, RCRA section 3020 specifically applies to all CERCLA and

¹ CERCLA remedial actions are required to meet Federal requirements and standards at completion of the remedial action if the Federal standards are applicable or relevant and appropriate requirements (ARARs), absent invocation of a statutory waiver. See CERCLA section 121(d). Agency policy and the proposed National contingency Plan (NCP) require the Agency to comply with all ARARs pertinent to the action during the course of a remedial action, as well as upon its completion. See the proposed NCP (published at 53 Fed. Reg. 51,394 (Dec. 21, 1988) (to be codified at 40 C.F.R. 300.43S(b)(2)), and CERCLA Compliance with Other Laws Manual: Part I, I-8 (OSWER Directive number 9234.1-01, August 8, 1988).

² RCRA section 3020 was section 7010 in the Hazardous and Solid Waste Amendments of 1984, but was re-numbered in 1986.

RCRA ground water treatment reinjections into class IV injection wells.³ Consistent with traditional principles of statutory construction, RCRA section 3020 -- which is directly focused on injections of treated contaminated ground water into Class IV wells during cleanups -- should be controlling for such injections; a contrary reading would render section 3020(b) meaningless. Where Congress has provided two potentially applicable statutory provisions, a choice between them is both necessary and appropriate, and within the discretion of the expert agency. Accordingly, EPA construes the provisions of RCRA section 3020 to be applicable instead of LDR provisions at RCRA sections 3004(f), (g), and (m), to reinfections of contaminated ground water into an underground source of drinking water (USDW), which are part of a CERCLA response action or RCRA corrective action.

. As a result, the three conditions of RCRA section 3020(b) must be met during response or corrective actions involving ground water treatment reinjection into or above underground sources of drinking water. Failure to meet these conditions bans the activity under RCRA section 3020(a).⁴ First, the injections must be part of a CERCLA response action or a RCRA corrective action. Second, each reinjection has to be treated to "substantially reduce hazardous constituents prior to such injection..." (RCRA section 3020(b)). Until guidance is prepared addressing the issue, steps necessary to "substantially reduce" hazardous constituents during a RCRA corrective action or a CERCLA response action should be decided on a case-by-case basis. Third, the response or corrective action upon completion must "be sufficient to protect human health and the environment" (RCRA section 3020(b)). RCRA and CERCLA statutes, regulations and policies should be reviewed to determine protectiveness.

The issue may also arise under CERCLA as to whether LDRs are relevant and appropriate requirement when treated ground water is reinjected into Class IV wells as part of a CERCLA response action. In order to be considered to be both "relevant" and "appropriate," a requirement must address problems or situations similar to the circumstances of the release or remedial action contemplated, and be well-suited to the site. A key factor in determining the potential relevance and appropriateness of a

³ Class IV injection wells are used to inject contaminated ground water into or above an underground source of drinking water. See 40 C.F.R. 146.5(d) In most situations, ground water treatment reinjection involves only Class IV injection wells because treated ground water is recharged back into an underground source of drinking water (USDW) during pump-and-treat activities, not beneath it. Other classes of wells are not subject to section 3020's special provisions.

⁴ Note, however, that an ARARs waiver may be appropriate in certain cases for actions taken under CERCLA.

Separate from the restrictions found in RCRA LDRs, an independent provision of the statute, RCRA Section 3020, bans hazardous waste injection into drinking water formations (Class IV injection wells), unless the conditions in subpart (b) are met. Subpart (b) permits reinjection of contaminated ground water that has been treated if: (1) the injection is a CERCLA response action or a RCRA corrective action, (2) the contaminated ground water is treated to substantially reduce hazardous constituents prior to each injection, and (3) the response action or corrective action is sufficient to protect human health and the environment upon completion. (See RCRA section 3020(b).)

For the reasons specified in the attachment to this memorandum, LDR is not applicable to these activities. Instead of LDR, RCRA section 3020 applies to reinjection of treated contaminated ground water into Class IV injection wells during CERCLA response actions or RCRA corrective actions. Moreover, for CERCLA response actions where the goal is to clean up ground water to drinking water levels, the Agency believes that health-based drinking water standards (e.g. MCLs) -- rather than LDRS -- will generally be the relevant and appropriate cleanup standard. See the attachment.

Until guidance addresses the issue, what is required to "substantially reduce" hazardous constituents prior to each injection in a CERCLA response action or RCRA corrective action should be determined on a case-by-case basis. RCRA and CERCLA program policies and guidance should be reviewed to determine protectiveness upon completion of the action.

Attachment

cc: CERCLA and RCRA Branch Chiefs
Office of Drinking Water

requirement is to compare the CERCLA response objective with the purpose and objective of the requirement. "See CERCLA compliance with Other Laws Manual" at p. 1-65 (EPA. August 8, 1988); proposed NCP, 53 FR at 51436 (Dec. 21, 1988) (proposed section 300.400(g)(2)).

The ultimate purpose of treating and reinjecting ground water into class IV walls is to restore the formation to drinking water quality. EPA¹ believes that standards that have been specifically developed to establish drinking water quality levels (such as MCLs⁵) are particularly well-suited to the accomplishment of that purpose. Although LDRs also prescribe treatment levels, those levels were not specifically developed to achieve drinking water quality (although they may often have that result). Thus, where drinking water standards are available, the Agency believes that they will generally be the relevant and appropriate requirement to use in setting treatment standards for CERCLA cleanups of drinking water formations.

In situations where no drinking water standard has been promulgated, for the contaminants to be treated, the Region should consider potentially relevant and appropriate requirements (including any available health-based standards, LDR treatment standards, etc.) and attain the standard, if any, that the Agency finds is "relevant and appropriate under the circumstances of the release" (or justify a waiver).⁶ EPA guidance sets out a number of factors for deciding if a requirement is relevant and appropriate under the circumstances of the release. See CERCLA. Compliance with Other Laws Manual, at p. 1-67.

NOTICE: The policies set out in this memorandum are intended solely for the guidance of Government personnel: They are not intended, nor can they be relied upon, to create any rights enforceable by any party in litigation with the United States. EPA officials may decide to follow the guidance provided in this memorandum, or to act at variance with the guidance, based on an analysis of specific site circumstances. The Agency also reserves the right to change this guidance at any time without public notice.

⁵ See the discussion of MCLs and MCLGs in the proposed and final NCP.

⁶ If no such standards are relevant and appropriate, TBCs may be used as cleanup levels; use of a TBC should be explained and justified for each specific case.